

AT-XP® Design Information — Concrete

AT-XP Tension Strength Design Data for Threaded Rod¹

Characteristic				Symbol	Units	Nominal Anchor Diameter d_a (in.)							
						$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	1 $\frac{1}{4}$	
Steel Strength in Tension													
Threaded Rod	Minimum Tensile Stress Area			A_{se}	in. ²	0.078	0.142	0.226	0.334	0.462	0.606	0.969	
	Tension Resistance of Steel — ASTM F1554, Grade 36			N_{sa}	lb.	4,525	8,235	13,110	19,370	26,795	35,150	56,200	
	Tension Resistance of Steel — ASTM A193, Grade B7					9,750	17,750	28,250	41,750	57,750	75,750	121,125	
	Tension Resistance of Steel — Type 410 Stainless (ASTM A193, Grade B6)					8,580	15,620	24,860	36,740	50,820	66,660	106,590	
	Tension Resistance of Steel — Type 304 and 316 Stainless (ASTM A193, Grade B8 and B8M)					4,445	8,095	12,880	19,040	26,335	34,540	55,235	
	Strength Reduction Factor — Steel Failure			ϕ	—	0.75 ⁶							
Concrete Breakout Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)													
Effectiveness Factor — Uncracked Concrete				k_{uncr}	—	24							
Effectiveness Factor — Cracked Concrete				k_{cr}	—	17							
Strength Reduction Factor — Breakout Failure				ϕ	—	0.65 ⁸							
Bond Strength in Tension (2,500 psi ≤ f'_c ≤ 8,000 psi)													
Uncracked Concrete ^{2,3,4}	Characteristic Bond Strength			$\tau_{k,uncr}$	psi	1,390	1,590	1,715	1,770	1,750	1,655	1,250	
	Permitted Embedment Depth Range		Minimum	h_{ef}	in.	2 $\frac{3}{8}$	2 $\frac{3}{4}$	3 $\frac{1}{8}$	3 $\frac{1}{2}$	3 $\frac{3}{4}$	4	5	
			Maximum			7 $\frac{1}{2}$	10	12 $\frac{1}{2}$	15	17 $\frac{1}{2}$	20	25	
Cracked Concrete ^{2,3,4}	Characteristic Bond Strength ^{9,10,11}			$\tau_{k,cr}$	psi	1,085	1,035	980	950	815	800	700	
	Permitted Embedment Depth Range		Minimum	h_{ef}	in.	3	3	3 $\frac{1}{8}$	3 $\frac{1}{2}$	3 $\frac{3}{4}$	4	5	
			Maximum			7 $\frac{1}{2}$	10	12 $\frac{1}{2}$	15	17 $\frac{1}{2}$	20	25	
Bond Strength in Tension — Bond Strength Reduction Factors for Continuous Special Inspection													
Strength Reduction Factor — Dry Concrete				ϕ_{dry}	—	0.65 ⁷					0.55 ⁷		
Strength Reduction Factor — Water-Saturated Concrete				ϕ_{sat}	—	0.45 ⁷							
Additional Factor for Water-Saturated Concrete				K_{sat}	—	0.54 ⁵		0.77 ⁵			0.96 ⁵		
Bond Strength in Tension — Bond Strength Reduction Factors for Periodic Special Inspection													
Strength Reduction Factor — Dry Concrete				ϕ_{dry}	—	0.55 ⁷					0.45 ⁷		
Strength Reduction Factor — Water-Saturated Concrete				ϕ_{sat}	—	0.45 ⁷							
Additional Factor for Water-Saturated Concrete				K_{sat}	—	0.46 ⁵		0.65 ⁵			0.81 ⁵		

- The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.
- Temperature Range: Maximum short-term temperature of 180°F. Maximum long-term temperature of 110°F.
- Short-term concrete temperatures are those that occur over short intervals (diurnal cycling).
- Long-term concrete temperatures are constant temperatures over a significant time period.
- In water-saturated concrete, multiply $\tau_{k,uncr}$ and $\tau_{k,cr}$ by K_{sat} .
- The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .
- The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .
- The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3 (c) for Condition A are met, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ . If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .
- For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values for 1/2", 3/8", 3/4" and 1" anchors must be multiplied by $\alpha_{N,seis} = 0.85$.
- For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values for 1 1/4" anchors must be multiplied by $\alpha_{N,seis} = 0.75$.
- For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values for 7/8" anchors must be multiplied by $\alpha_{N,seis} = 0.59$.

* See p. 12 for an explanation of the load table icons.

AT-XP® Design Information — Concrete

AT-XP Tension Strength Design Data for Rebar¹



Characteristic			Symbol	Units	Rebar Size						
					#3	#4	#5	#6	#7	#8	#10
Steel Strength in Tension											
Rebar	Minimum Tensile Stress Area		A_{se}	in. ²	0.11	0.2	0.31	0.44	0.6	0.79	1.27
	Tension Resistance of Steel — Rebar (ASTM A615 Grade 60)		N_{sa}	lb.	9,900	18,000	27,900	39,600	54,000	71,100	114,000
	Tension Resistance of Steel — Rebar (ASTM A706 Grade 60)				8,800	16,000	24,800	35,200	48,000	63,200	101,600
	Strength Reduction Factor — Steel Failure		ϕ	—	0.75 ⁶						
Concrete Breakout Strength in Tension (2,500 psi ≤ f _c ≤ 8,000 psi)											
Effectiveness Factor — Uncracked Concrete			k_{uncr}	—	24						
Effectiveness Factor — Cracked Concrete			k_{cr}		17						
Strength Reduction Factor — Breakout Failure			ϕ	—	0.65 ⁸						
Bond Strength in Tension (2,500 psi ≤ f _c ≤ 8,000 psi)											
Uncracked Concrete ^{2,3,4}	Characteristic Bond Strength		$\tau_{k,uncr}$	psi	1,010	990	970	955	935	915	875
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	2¾	2¾	3⅛	3½	3¾	4	5
		Maximum			7½	10	12½	15	17½	20	25
Cracked Concrete ^{2,3,4}	Characteristic Bond Strength		$\tau_{k,cr}$	psi	340	770	780	790	795	795	820
	Permitted Embedment Depth Range	Minimum	h_{ef}	in.	3	3	3⅛	3½	3¾	4	5
		Maximum			7½	10	12½	15	17½	20	25
Bond Strength in Tension — Bond Strength Reduction Factors for Continuous Special Inspection											
Strength Reduction Factor — Dry Concrete			ϕ_{dry}	—	0.65 ⁷						
Strength Reduction Factor — Water-Saturated Concrete			ϕ_{sat}	—	0.45 ⁷						
Additional Factor for Water-Saturated Concrete			K_{sat}	—	0.54 ⁵		0.77 ⁵			0.96 ⁵	
Bond Strength in Tension — Bond Strength Reduction Factors for Periodic Special Inspection											
Strength Reduction Factor — Dry Concrete			ϕ_{dry}	—	0.55 ⁷						
Strength Reduction Factor — Water-Saturated Concrete			ϕ_{sat}	—	0.45 ⁷						
Additional Factor for Water-Saturated Concrete			K_{sat}	—	0.46 ⁵		0.65 ⁵			0.81 ⁵	

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.

2. Temperature Range: Maximum short-term temperature of 180°F. Maximum long-term temperature of 110°F.

3. Short-term concrete temperatures are those that occur over short intervals (diurnal cycling).

4. Long-term concrete temperatures are constant temperatures over a significant time period.

5. In water-saturated concrete, multiply $\tau_{k,uncr}$ and $\tau_{k,cr}$ by K_{sat} .

6. The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used.

If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .

7. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .

8. The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition A are met. If the load combinations of ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3 (c) for Condition A are met, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ . If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .

* See p. 12 for an explanation of the load table icons.

AT-XP® Design Information — Concrete

AT-XP Shear Strength Design Data for Threaded Rod¹

Characteristic		Symbol	Units	Nominal Anchor Diameter (in.)						
				3⁄8	1⁄2	5⁄8	3⁄4	7⁄8	1	1 1⁄4
Steel Strength in Shear										
Threaded Rod	Minimum Shear Stress Area	A_{se}	in. ²	0.078	0.142	0.226	0.334	0.462	0.606	0.969
	Shear Resistance of Steel — ASTM F1554, Grade 36	V_{sa}	lb.	2,260	4,940	7,865	11,625	16,080	21,090	33,720
	Shear Resistance of Steel — ASTM A193, Grade B7			4,875	10,650	16,950	25,050	34,650	45,450	72,675
	Shear Resistance of Steel — Type 410 Stainless (ASTM A193, Grade B6)			4,290	9,370	14,910	22,040	30,490	40,000	63,955
	Shear Resistance of Steel — Type 304 and 316 Stainless (ASTM A193, Grade B8 and B8M)			2,225	4,855	7,730	11,425	15,800	20,725	33,140
	Reduction for Seismic Shear — ASTM F1554, Grade 36	$\alpha_{V_{seis}}^5$	—	0.85						
	Reduction for Seismic Shear — ASTM A193, Grade B7			0.85						
	Reduction for Seismic Shear — Type 410 Stainless (ASTM A193, Grade B6)			0.85	0.75					0.85
	Reduction for Seismic Shear — Type 304 and 316 Stainless (ASTM A193, Grade B8 and B8M)			0.85	0.75					0.85
	Strength Reduction Factor — Steel Failure	ϕ	—	0.65 ²						
Concrete Breakout Strength in Shear										
Diameter of Anchor		d_a	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Load-Bearing Length of Anchor in Shear		ℓ_e	in.	Min. of h_{ef} and 8 times anchor diameter						
Strength Reduction Factor — Breakout Failure		ϕ	—	0.70 ³						
Concrete Pryout Strength in Shear										
Coefficient for Pryout Strength		k_{cp}	—	1.0 for $h_{ef} < 2.50''$; 2.0 for $h_{ef} \geq 2.50''$						
Strength Reduction Factor — Pryout Failure		ϕ	—	0.70 ⁴						

- The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.
- The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .
- The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3 (c) for Condition A are met, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ . If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .
- The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .
- The values of V_{sa} are applicable for both cracked concrete and uncracked concrete. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, V_{sa} must be multiplied by $\alpha_{V_{seis}}$ for the corresponding anchor steel type.

* See p. 12 for an explanation of the load table icons.

AT-XP® Design Information — Concrete

AT-XP Shear Strength Design Data for Rebar¹

Characteristic		Symbol	Units	Rebar Size						
				#3	#4	#5	#6	#7	#8	#10
Steel Strength in Shear										
Rebar	Minimum Shear Stress Area	A_{se}	in. ²	0.11	0.2	0.31	0.44	0.6	0.79	1.27
	Shear Resistance of Steel — Rebar (ASTM A615 Grade 60)	V_{sa}	lb.	4,950	10,800	16,740	23,760	32,400	42,660	68,580
	Shear Resistance of Steel — Rebar (ASTM A706 Grade 60)			4,400	9,600	14,880	21,120	28,800	37,920	60,960
	Reduction for Seismic Shear — Rebar (ASTM A615 Grade 60)	$\alpha_{V,seis}^5$	—	0.56			0.80			
	Reduction for Seismic Shear — Rebar (ASTM A706 Grade 60)			0.56			0.80			
	Strength Reduction Factor — Steel Failure	ϕ		0.65 ²						
Concrete Breakout Strength in Shear										
Diameter of Anchor		d_a	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Load-Bearing Length of Anchor in Shear		ℓ_e	in.	Min. of h_{ef} and 8 times anchor diameter						
Strength Reduction Factor — Breakout Failure		ϕ	—	0.70 ³						
Concrete Pryout Strength in Shear										
Coefficient for Pryout Strength		k_{cp}	—	1.0 for $h_{ef} < 2.50''$; 2.0 for $h_{ef} \geq 2.50''$						
Strength Reduction Factor — Pryout Failure		ϕ	—	0.70 ⁴						

- The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.
- The value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .
- The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Section 9.2 are used and the requirements of ACI 318-11 D.4.3 (c) for Condition A are met, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ . If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .
- The value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3 or ACI 318-11 D.4.3 (c) for Condition B are met. If the load combinations of ACI 318 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .
- The values of V_{sa} are applicable for both cracked concrete and uncracked concrete. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, V_{sa} must be multiplied by $\alpha_{V_{seis}}$ for the corresponding anchor steel type.

For additional load tables, visit strongtie.com/atxp.



Anchor Designer™ Software for ACI 318, ETAG and CSA

Simpson Strong-Tie® Anchor Designer software accurately analyzes existing design or suggests anchor solutions based on user-defined design elements in cracked and uncracked concrete conditions.

* See p. 12 for an explanation of the load table icons.

AT-XP® Design Information — Masonry

AT-XP Allowable Tension and Shear Loads for Threaded Rod and Rebar
in the Face of Fully Grouted CMU Wall Construction^{1, 3, 4, 5, 6, 8, 9, 10, 11}



Diameter (in.) or Rebar Size No.	Drill Bit Diameter (in.)	Minimum Embedment ² (in.)	Allowable Load Based on Bond Strength ⁷ (lb.)	
			Tension Load	Shear Load
Threaded Rod Installed in the Face of CMU Wall				
3⁄8	1⁄2	3 3⁄8	1,265	1,135
1⁄2	5⁄8	4 1⁄2	1,910	1,660
5⁄8	3⁄4	5 5⁄8	2,215	1,810
3⁄4	7⁄8	6 3⁄4	2,260	1,810
Rebar Installed in the Face of CMU Wall				
#3	1⁄2	3 3⁄8	1,180	1,315
#4	5⁄8	4 1⁄2	1,720	1,565
#5	3⁄4	5 5⁄8	1,835	1,565

1. Allowable load shall be the lesser of the bond values shown in this table and steel values, shown on p. 62.
2. Embedment depth shall be measured from the outside face of masonry wall.
3. Critical and minimum edge distance and spacing shall comply with the information on p. 61. Figure 2 on p. 61 illustrates critical and minimum edge and end distances.
4. Minimum allowable nominal width of CMU wall shall be 8". No more than one anchor shall be permitted per masonry cell.
5. Anchors shall be permitted to be installed at any location in the face of the fully grouted masonry wall construction (cell, web, bed joint), except anchors shall not be installed within 1 1/2" of the head joint, as show in Figure 2 on p. 61.
6. Tabulated allowable load values are for anchors installed in fully grouted masonry walls.
7. Tabulated allowable loads are based on a safety factor of 5.0.
8. Tabulated allowable load values shall be adjusted for increased base material temperatures in accordance with Figure 1 below, as applicable.
9. Threaded rod and rebar installed in fully grouted masonry walls are permitted to resist dead, live, seismic and wind loads.
10. Threaded rod shall meet or exceed the tensile strength of ASTM F1554, Grade 36 steel, which is 58,000 psi.
11. For installations exposed to severe, moderate or negligible exterior weathering conditions, as defined in Figure 1 of ASTM C62, allowable tension loads shall be multiplied by 0.80.

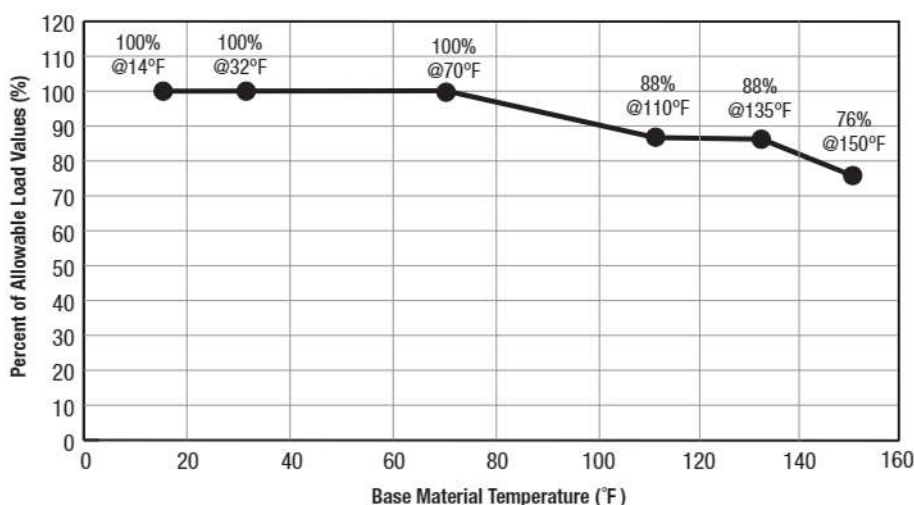


Figure 1. Load Capacity Based on In-Service Temperature for AT-XP Adhesive in the Face of Fully Grouted CMU Wall Construction

* See p. 12 for an explanation of the load table icons.

AT-XP® Design Information — Masonry

AT-XP Edge Distance and Spacing Requirements and Allowable Load Reduction Factors — Threaded Rod and Rebar in the Face of Fully Grouted CMU Wall Construction⁷



Rod Dia. (in.) or Rebar Size No.	Minimum Embed. Depth (in.)	Edge or Edge Distance ^{1,8}						Spacing ^{2,9}				
		Critical (Full Anchor Capacity) ³		Minimum (Reduced Anchor Capacity) ⁴				Critical (Full Anchor Capacity) ⁵		Minimum (Reduced Anchor Capacity) ⁶		
		Critical Edge or End Distance, C _{cr} (in.)	Allowable Load Reduction Factor	Minimum Edge or End Distance, C _{min} (in.)	Allowable Load Reduction Factor			Critical Spacing, S _{cr} (in.)	Allowable Load Reduction Factor	Minimum Spacing, S _{min} (in.)	Allowable Load Reduction Factor	
		Load Direction		Load Direction				Load Direction		Load Direction		
		Tension or Shear	Tension or Shear	Tension or Shear	Tension	Shear ¹⁰		Tension or Shear	Tension or Shear	Tension or Shear	Tension	Shear
						Perp.	Para.					
⅜	3⅝	12	1.00	4	1.00	0.76	0.94	8	1.00	4	1.00	1.00
½	4½	12	1.00	4	0.90	0.57	0.94	8	1.00	4	1.00	1.00
⅝	5⅝	12	1.00	4	0.72	0.47	0.94	8	1.00	4	1.00	1.00
¾	6¾	12	1.00	4	0.72	0.47	0.94	8	1.00	4	1.00	1.00
#3	3⅝	12	1.00	4	1.00	0.62	0.95	8	1.00	4	1.00	1.00
#4	4½	12	1.00	4	1.00	0.37	0.82	8	1.00	4	1.00	0.89
#5	5⅝	12	1.00	4	1.00	0.37	0.82	8	1.00	4	1.00	0.89

- Edge distance (C_{cr} or C_{min}) is the distance measured from anchor centerline to edge or end of CMU masonry wall. Refer to Figure 2 below for an illustration showing critical and minimum edge and end distances.
- Anchor spacing (S_{cr} or S_{min}) is the distance measured from centerline to centerline of two anchors.
- Critical edge distance, C_{cr} , is the least edge distance at which tabulated allowable load of an anchor is achieved where a load reduction factor equals 1.0 (no load reduction).
- Minimum edge distance, C_{min} , is the least edge distance where an anchor has an allowable load capacity which shall be determined by multiplying the allowable loads assigned to anchors installed at critical edge distance, C_{cr} , by the load reduction factors shown above.
- Critical spacing, S_{cr} , is the least anchor spacing at which tabulated allowable load of an anchor is achieved such that anchor performance is not influenced by adjacent anchors.
- Minimum spacing, S_{min} , is the least spacing where an anchors has an allowable load capacity, which shall be determined by multiplying the allowable loads assigned to anchors installed at critical spacing distance, S_{cr} , by the load reduction factors shown above.
- Reduction factors are cumulative. Multiple reduction factors for more than one spacing or edge or end distance shall be calculated separately and multiplied.
- Load reduction factor for anchors loaded in tension or shear with edge distances between critical and minimum shall be obtained by linear interpolation.
- Load reduction factor for anchors loaded in tension with spacing between critical and minimum shall be obtained by linear interpolation.
- Perpendicular shear loads act towards the edge or end. Parallel shear loads act parallel to the edge or end (see Figure 3 below). Perpendicular and parallel shear load reduction factors are cumulative when the anchor is located between the critical minimum edge and end distance.

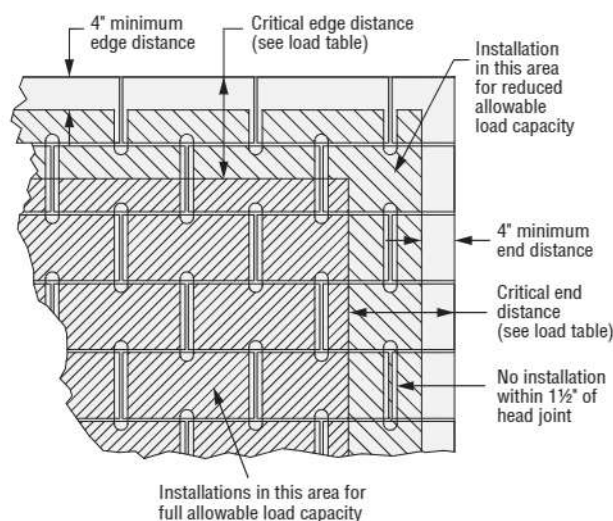


Figure 2. Allowable Anchor Locations for Full and Reduced Load Capacity When Installation Is in the Face of Fully Grouted CMU Masonry Wall Construction

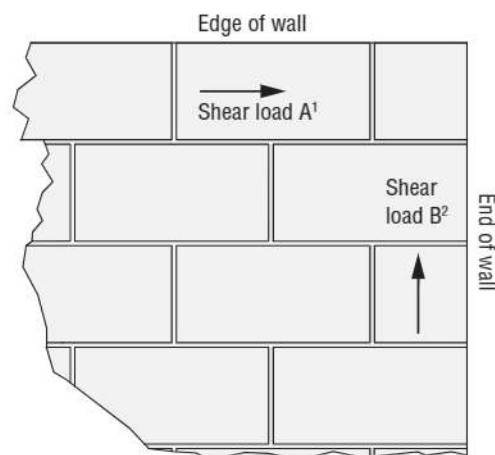


Figure 3. Direction of Shear Load in Relation to Edge and End of Wall

- Direction of Shear Load A is parallel to edge of wall and perpendicular to end of wall.
- Direction of Shear Load B is parallel to end of wall and perpendicular to edge of wall.

* See p. 12 for an explanation of the load table icons.

AT-XP® Design Information — Steel

AT-XP Allowable Tension and Shear Loads — Threaded Rod Based on Steel Strength¹



Threaded Rod Diameter (in.)	Tensile Stress Area (in. ²)	Tension Load Based on Steel Strength ² (lb.)				Shear Load Based on Steel Strength ³ (lb.)			
		ASTM F1554 Grade 36 ⁴	ASTM A193 Grade B7 ⁶	Stainless Steel		ASTM F1554 Grade 36 ⁴	ASTM A193 Grade B7 ⁶	Stainless Steel	
				ASTM A193 Grade B6 ⁵	ASTM A193 Grades B8 and B8M ⁷			ASTM A193 Grade B6 ⁵	ASTM A193 Grades B8 and B8M ⁷
3/8	0.078	1,495	3,220	2,830	1,930	770	1,660	1,460	995
1/2	0.142	2,720	5,860	5,155	3,515	1,400	3,020	2,655	1,810
5/8	0.226	4,325	9,325	8,205	5,595	2,230	4,805	4,225	2,880
3/4	0.334	6,395	13,780	12,125	8,265	3,295	7,100	6,245	4,260

- Allowable load shall be the lesser of bond values given on p. 60 and steel values in the table above.
- Allowable Tension Steel Strength is based on the following equation: $F_u = 0.33 \times F_u \times \text{Tensile Stress Area}$.
- Allowable Shear Steel Strength is based on the following equation: $F_v = 0.17 \times F_u \times \text{Tensile Stress Area}$.
- Minimum specified tensile strength ($F_u = 58,000$ psi) of ASTM F1554, Grade 36 used to calculate allowable steel strength.
- Minimum specified tensile strength ($F_u = 110,000$ psi) of ASTM A193, Grade B6 used to calculate allowable steel strength.
- Minimum specified tensile strength ($F_u = 125,000$ psi) of ASTM A193, Grade B7 used to calculate allowable steel strength.
- Minimum specified tensile strength ($F_u = 75,000$ psi) of ASTM A193, Grades B8 and B8M used to calculate allowable steel strength.

AT-XP Allowable Tension and Shear Loads — Deformed Reinforcing Bar Based on Steel Strength¹



Drill Bit Diameter (in.)	Minimum Embedment ² (in.)	Tension Load (lb.)		Shear Load (lb.)	
		Based on Steel Strength		Based on Steel Strength	
		ASTM A615 Grade 40 ²	ASTM A615 Grade 60 ³	ASTM A615 Grade 40 ^{4,5}	ASTM A615 Grade 60 ^{4,6}
#3	0.11	2,200	2,640	1,310	1,685
#4	0.20	4,000	4,800	2,380	3,060
#5	0.31	6,200	7,440	3,690	4,745

- Allowable load shall be the lesser of bond values given on p. 60 and steel values in the table above.
- Allowable Tension Steel Strength is based on AC58 Section 3.3.3 (20,000 psi x tensile stress area) for Grade 40 rebar.
- Allowable Tension Steel Strength is based on AC58 Section 3.3.3 (24,000 psi x tensile stress area) for Grade 60 rebar.
- Allowable Shear Steel Strength is based on AC58 Section 3.3.3 ($F_v = 0.17 \times F_u \times \text{Tensile Stress Area}$).
- $F_u = 70,000$ psi for Grade 40 rebar.
- $F_u = 90,000$ psi for Grade 60 rebar.

* See p. 12 for an explanation of the load table icons.

AT-XP® Design Information — Masonry

AT-XP Allowable Tension and Shear Loads —
Threaded Rod in the Face of Hollow CMU Wall Construction^{1,3,4,5,6,8,9,10,11}



Diameter (in.)	Drill Bit Diameter (in.)	Minimum Embedment Depth ² (in.)	Allowable Load Based on Bond Strength ⁷ (lb.)	
			Tension	Shear
3/8	5/16	1 1/4	225	275
1/2	3/4	1 1/4	220	315
5/8	7/8	1 1/4	215	355

- Allowable load shall be the lesser of bond values shown in this table and steel values shown on p. 62.
- Embedment depth is considered the minimum wall thickness of 8" x 8" x 16" ASTM C90 concrete masonry blocks, and is measured from the outside to the inside face of the block wall. The minimum length Opti-Mesh plastic screen tube for use in hollow CMU is 3 1/2".
- Critical and minimum edge distance and spacing shall comply with the information provided on p. 63. Figure 4 on p. 63 illustrates critical and minimum edge and end distances.
- Anchors are permitted to be installed in the face shell of hollow masonry wall construction as shown in Figure 4.
- Anchors are limited to one or two anchors per masonry cell and must comply with the spacing and edge distance requirements provided.
- Tabulated load values are for anchors installed in hollow masonry walls.
- Tabulated allowable loads are based on a safety factor of 5.0.
- Tabulated allowable load values shall be adjusted for increased base material temperatures in accordance with Figure 1 on p. 60, as applicable.
- Threaded rods installed in hollow masonry walls with AT-XP adhesive are permitted to resist dead, live load and wind load applications.
- Threaded rods must meet or exceed the tensile strength of ASTM F1554, Grade 36, which is 58,000 psi.
- For installations exposed to severe, moderate or negligible exterior weathering conditions, as defined in Figure 1 of ASTM C62, allowable tension loads must be multiplied by 0.80.

AT-XP Edge, End and Spacing Distance Requirements and Allowable Load
Reduction Factors — Threaded Rod in the Face of Hollow CMU Wall Construction⁷



Rod Diameter (in.)	Edge or End Distance ^{1,8}					Spacing ^{2,9}				
	Critical (Full Anchor Capacity) ³		Minimum (Reduced Anchor Capacity) ⁴			Critical (Full Anchor Capacity) ⁵		Minimum (Reduced Anchor Capacity) ⁶		
	Critical Edge or End Distance, C_{cr} (in.)	Allowable Load Reduction Factor	Minimum Edge or End Distance, C_{min} (in.)	Allowable Load Reduction Factor		Critical Spacing, S_{cr} (in.)	Allowable Load Reduction Factor	Minimum Spacing, S_{min} (in.)	Allowable Load Reduction Factor	
	Load Direction		Load Direction			Load Direction		Load Direction		
	Tension or Shear	Tension or Shear	Tension or Shear	Tension	Shear ¹⁰	Tension or Shear	Tension or Shear	Tension or Shear	Tension	Shear
3/8	12	1.00	4	1.00	1.00	8	1.00	4	0.74	1.00
1/2	12	1.00	4	1.00	1.00	8	1.00	4	0.76	0.89
5/8	12	1.00	4	1.00	0.89	8	1.00	4	0.78	0.77

- Edge and end distances (C_{cr} or C_{min}) are the distances measured from anchor centerline to edge or end of CMU masonry wall. Refer to Figure 4 (on the right) for an illustration showing critical and minimum edge and end distances.
- Anchor spacing (S_{cr} or S_{min}) is the distance measured from centerline to centerline of two anchors.
- Critical edge and end distances, C_{cr} , are the least edge distances at which tabulated allowable load of an anchor is achieved where a load reduction factor equals 1.0 (no load reduction).
- Minimum edge and end distances, C_{min} , are the least edge distances where an anchor has an allowable load capacity which shall be determined by multiplying the allowable loads assigned to anchors installed at critical edge distance, C_{cr} , by the load reduction factors shown above.
- Critical spacing, S_{cr} , is the least anchor spacing at which tabulated allowable load of an anchor is achieved such that anchor performance is not influenced by adjacent anchors.
- Minimum spacing, S_{min} , is the least spacing where an anchor has an allowable load capacity, which shall be determined by multiplying the allowable loads assigned to anchors installed at critical spacing distance, S_{cr} , by the load reduction factors shown above.
- Reduction factors are cumulative. Multiple reduction factors for more than one spacing or edge or end distance shall be calculated separately and multiplied.
- Load reduction factor for anchors loaded in tension or shear with edge distances between critical and minimum shall be obtained by linear interpolation.
- Load reduction factor for anchors loaded in tension with spacing between critical and minimum shall be obtained by linear interpolation.
- Perpendicular shear loads act toward the edge or end. Parallel shear loads act parallel to the edge or end (see Figure 3 on p. 61). Perpendicular and parallel shear load reduction factors are cumulative when the anchor is located between the critical minimum edge and end distance.

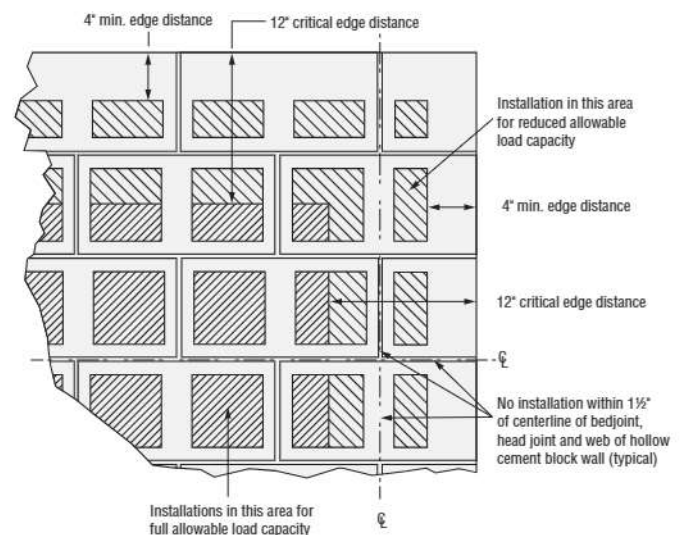


Figure 4. Allowable Anchor Locations for Full and Reduced Load Capacity When Installation Is in the Face of Hollow CMU Masonry Wall Construction

* See p. 12 for an explanation of the load table icons.